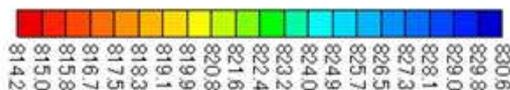
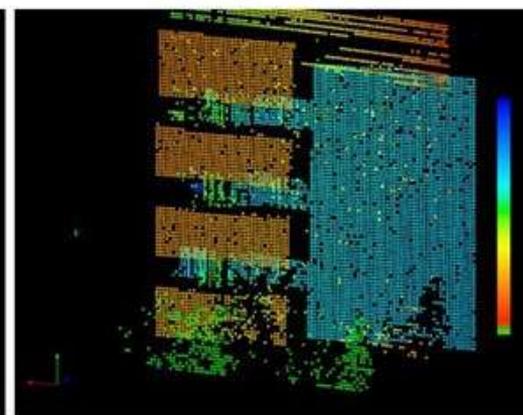
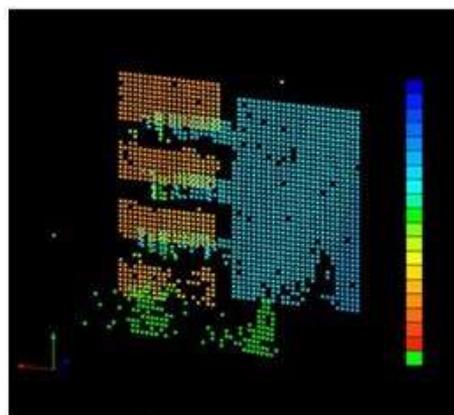
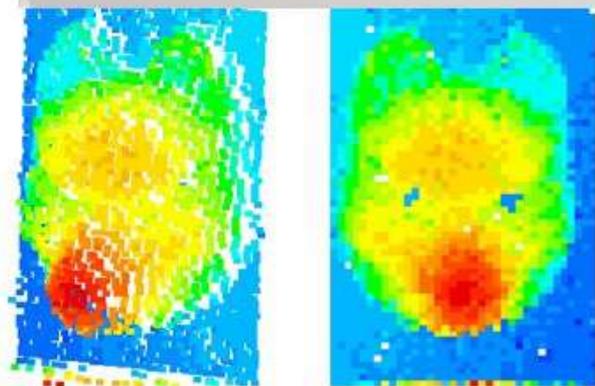




Distance~200m



SteraVision

SteraVision. Co., Ltd

- (1) Established in December 2016
- (2) Venture company originating from AIST (AIST*1)
- (3) Development, manufacturing, and sales of Lidar
- (4) Development center is Tsukuba AIST, Head office is located at Tsukuba Research Support Center (Tsukuba City)
- (5) Website: <https://steravison.com>

*1 AIST: National Institute of Advanced Industrial Science and Technology



Our Strength

- **We have a revolutionary core technology of FMCW LiDAR, which is the main technology that can realize fully automatic driving (Level4/5).**
- **Realization of a complete solid-state scanner with no moving parts applicable to FMCW LiDAR with a special liquid crystal**
- **Capable of weighted warp scanning to see as much as you want, where you want**
- **Competitive advantage in core technologies (MEMS vs Multipol, TOF vs FMCW)**

Performance

Competitive advantage

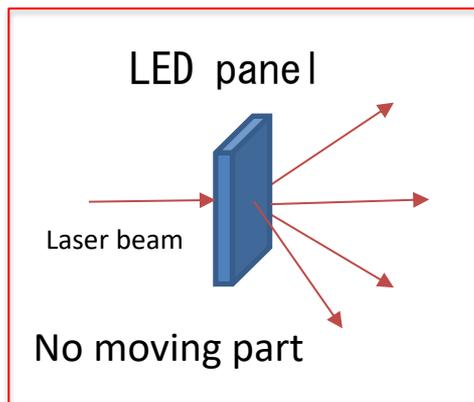
Outline and size

Our Vision and core product

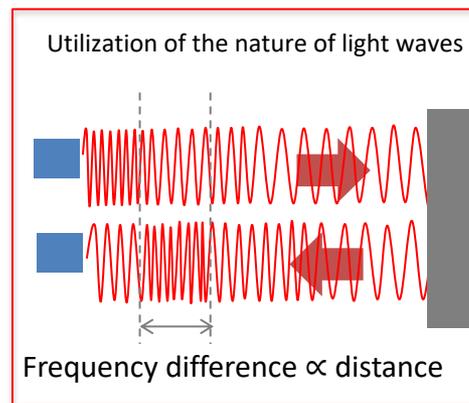
- Realization of human-like "eyes"
- Realizing "eyes" that see things that humans cannot see

Making the invisible visible!

LED Scanner
(MultiPol™)



FMCW method



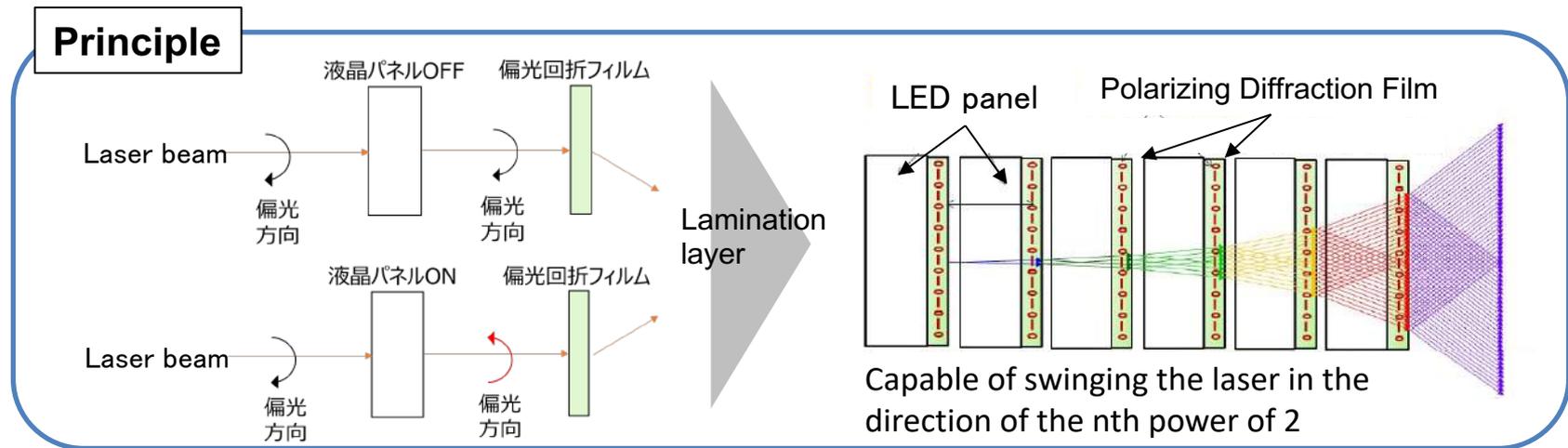
LiDAR, the "eyes" of fully automated vehicles



Features of the LCD scanner (MultiPol™)

LCD scanner applicable to FMCW-LiDAR

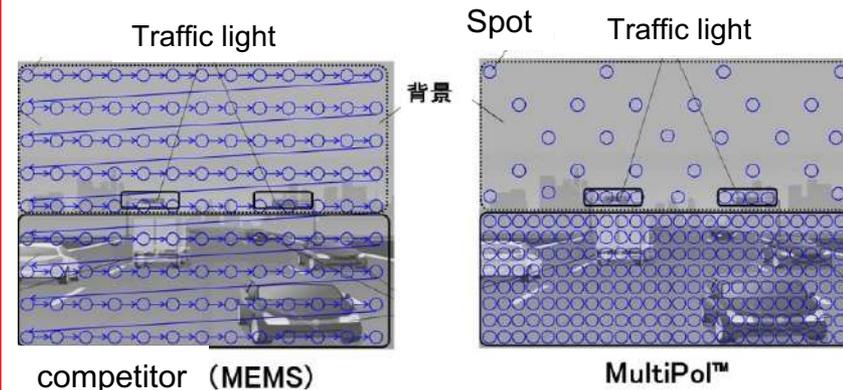
- ✓ A **complete Solid-State scanner** with no moving parts
- ✓ Special liquid crystal for low light loss, wide angle and fast scanner
- ✓ Weighted vision system (warp scan) to **see where you want, as much as you want**



Comparison of method

	MEMS	LD Array with Fourier Lens	Phased Array	MultiPol
FMCW	×	×	○	○
Moving part	Y	N	N	N
Steering angle	±20°	±20°	±1~2°	±60°
Velocity	~few10kHz	~μs	Depend on optical effect	~10μs

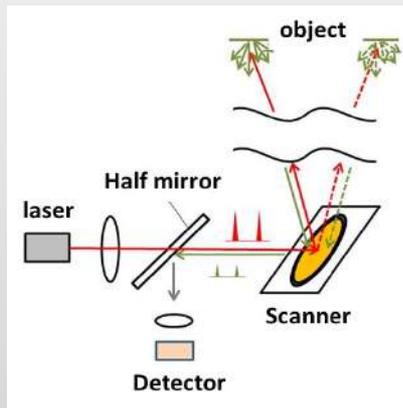
Warp scan



Features of our LiDAR

Think FMCW-LiDAR is the real deal for fully automated driving (Lv4/5).

Existing LiDAR(ToF)



Using the properties of light grains

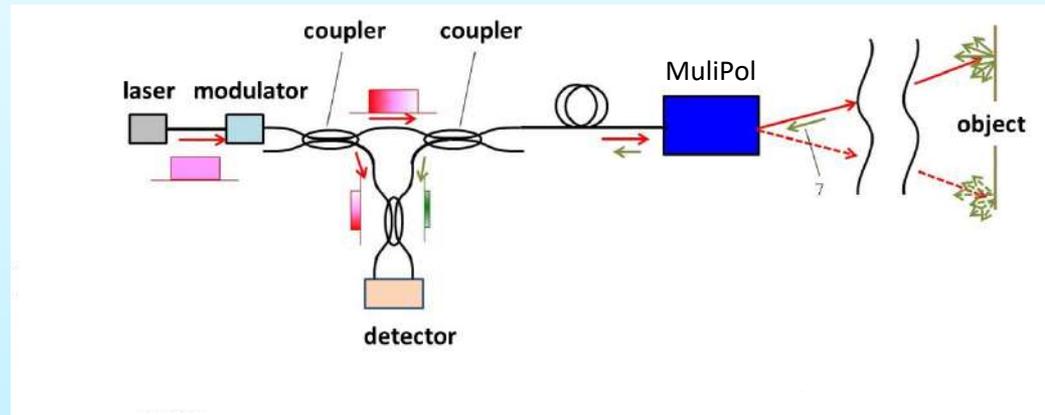
Advantages

- Can be configured with relatively inexpensive components

Issue

- Difficult to measure at a distance
- Susceptible to bad weather and backlighting (background light)
- Confusion with laser light from other vehicles

Our LiDAR(FMCW)



Utilizing the nature of light waves

Advantages

- **Highly sensitive LiDAR that is independent of distance**
- **Long range measurement of 200m or more is possible**
- **Resistant to bad weather conditions (fog, rain) and backlighting (background light)**
- **No interference with other vehicles' laser beams due to the self-interference effect of the laser beam**

Issue

- High prices (lasers and other optical components)
=> Digital signal processing technology enables use of low-cost semiconductor lasers Development underway to

Target Performance of LiDAR for Automotive Applications

Item	Target Performance	Development contents
Number of pixels	1200 x 400	<ul style="list-style-type: none"> ➤ Low voltage and low loss MultiPol ➤ 32/64ch multi optical system
Angle decomposition energy	0.1~0.8 deg(center - around)	
cape vision	120° (Horizontal) x 40° (Vertical)	<ul style="list-style-type: none"> ➤ 32/64(8/16ch x 4ch) multi
Distance measurement range	Long range : 3~300m位 Mid range : 0.1~100m位	<ul style="list-style-type: none"> ➤ Low voltage and low loss MultiPol ➤ Depends on applicable LD
Distance resolution	<2.5cm	<ul style="list-style-type: none"> ➤ Depending on allied LD ➤ After development of new LD, <2.5cm in long distance
Relative velocity	~200km/h	
Vibration countermeasures	Y	<ul style="list-style-type: none"> ➤ Dual Beat化
Frame rate	(~10fps)	<ul style="list-style-type: none"> ➤ 32/64ch ADC board、GPU software
Autonomous Scan (image compression)	Y	<ul style="list-style-type: none"> ➤ Algorithm Development
Power supply	+12V Sigle	
Weight		
Size	Head module : 50 x 45 x 70 mm ³ Main : 195 x 120 x 310 mm ³	

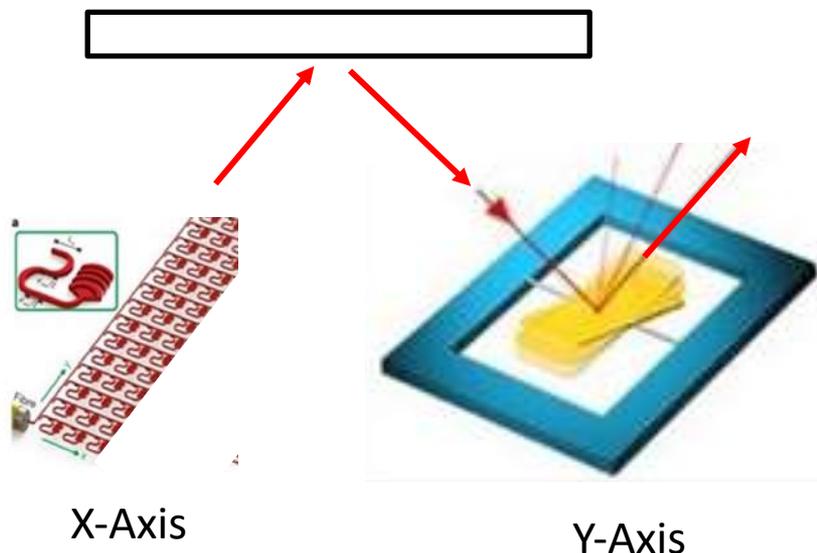
Performance

Competitive advantage

Outline and size

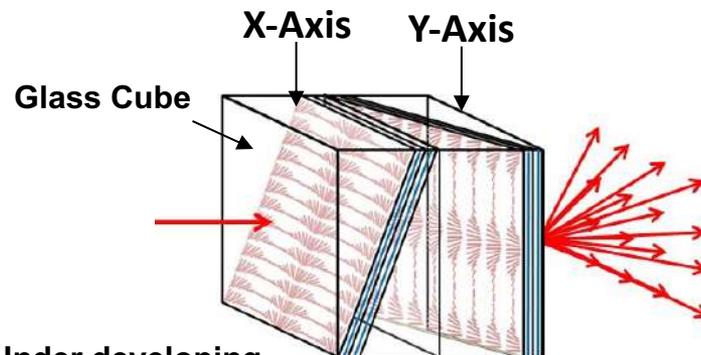
Comparison (MultiPol vs MEMS)

(1) OPA(MEMS)+MEMS

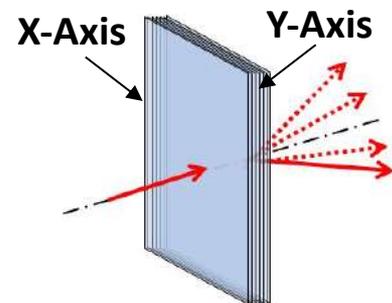


(2) MultiPol™

① Existing products



② Under developing



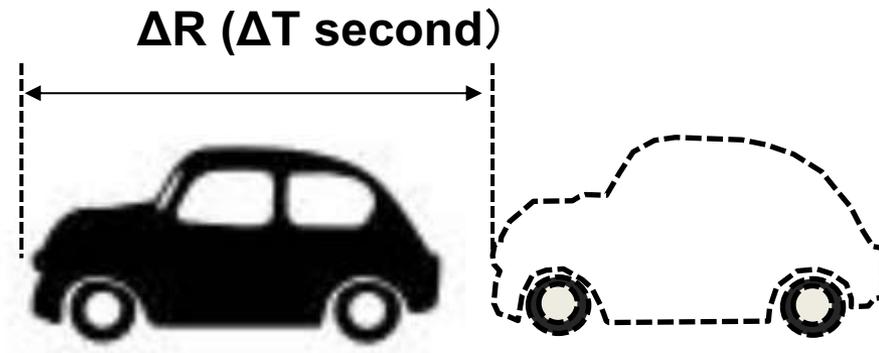
- Strictly speaking, there are moving parts (MEMS)
- Complicated input/output optical system (to drive X, Y axes separately)
- High voltage (MEMS to 150V)
- MEMS is limited to static mode in FMCW due to analog motion
Because of analog motion, MEMS is limited to Static Mode and slow.

- True solid state
- Simple input/output optics (for transmission type)
- Capable of digital-like movement (suitable for FMCW)
- Conventional products have large dimensions and high voltage (~150V)
- New electrode structure enables smaller size and constant voltage

Advantage of our Lidar (1) (Direct detection of velocity)

(1) competitors (ToF) method

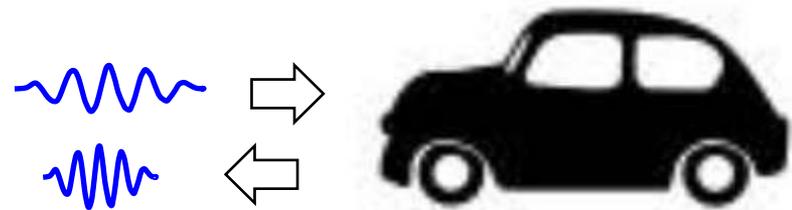
- Find the speed ($\Delta R/\Delta T$) from the difference in distance R between frames
- Immediately human/vehicle attributes (moving objects) Difficult to derive
- Can only be used for slow, automatic driving



(2) SteraVision (FMCW) method

- Doppler effect can be used to directly determine the speed of an object
- Attributes of people and cars (moving objects) can be derived
- Fast automatic driving can be realized

Doppler effect (reflected light changes the light wavelength)



Strengths of our Lidar (2) (Resistance to vibration)

- Optical FMCWs are sensitive to the Doppler effect and are therefore affected by the vibration of the vehicle.
- Our unique signal processing technology allows us to measure distance and speed with high accuracy even when the car is vibrating.

(1) Without vibration



(2) With vibration



(3) Our method



Performance

Competitive advantage

Outline and size

Prototype

